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The Annual Cycle of a Population of the Water Bug *Anisops assimilis* White and its Parasitic Mite

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Abstract

IN a pond in Otago the dominant primary consumer in the plankton was the copepod *Boeckella triarticulata*, and the secondary consumer was the bug *Anisops assimilis*. Few bugs were present in the winter, but they were numerous in summer and nymphs were taken between December and April. The bugs were parasitised by a mite, *Hydrachna* sp., from February to June. During this period 343 adult and 711 nymphal bugs were collected, and of them 68 and 98 respectively were parasitised. A total of 207 parasites was present, and of these 75.8% were on the thorax of the bug.

DURING the period July, 1960, to June, 1961, regular observations were made on the plankton of a pond. Numerous individuals of the bug *Anisops assimilis* White were captured, and many of them were parasitised by the larva of a mite. Corixid bugs, *Sigara arguta* White, were also present but were not extensively collected and only one was seen to be parasitised.

The pond is situated on a dissected peneplain of Central Otago schist, near Sutton, Otago. It is at a height of 1,400ft, and lies 46 miles by road from Dunedin in a westerly direction. The pond is an artificial impoundment of water, built in 1956 as a water supply for stock, and has a surface area of 2,275 square metres. The average depth varies between 100 and 140 cms, according to season. The climate of the area is rigorous, with an average minimum air temperature of —1.1° C. during the sampling period.

The dominant member of the zooplankton was the copepod *Boeckella triarticulata* (Thomson), though at times considerable numbers of the Cladoceran *Daphnia carinata* King were present. The bugs were caught in the main in tow-net hauls at the surface of the water, and no special methods were employed for catching them. Adequate sampling of an extremely agile animal in water is very difficult, and to take the tow-net samples as indicative of the total number of bugs present is to assume that the sampling error, due to the ability of bugs to avoid the net, is the same all the year round. My impression is that the juvenile stages do not avoid the net easily.

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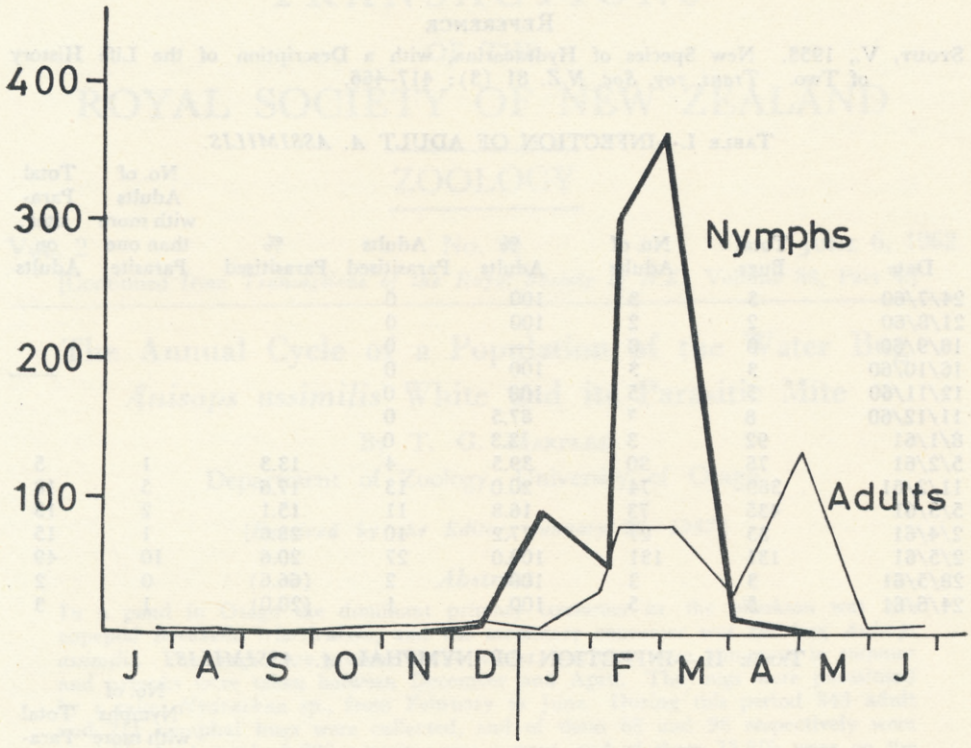
The results show something of the life history of *Anisops assimilis*. Very few adult bugs were present over the winter months, and all seemed to be highly sclerotised especially on the thorax. Often they had growing on them filamentous algae and two encrusting organisms, one a diatom and the other what appeared to be a sessile ciliate.

Breeding began in December; by 8/1/61 nymphs made up 96% of the total caught, and the last nymphs were taken on 2/4/61. The total number of bugs fell after this date, by 2/5/61 to five only, which is similar to the number caught during the previous winter. This may possibly be due to the migration of the winged adults away from the pond. The highest number of bugs caught in one haul of the tow-net (a haul of 32 metres, using a net with an opening 30cm in diameter) was 435, and of these 73 were adults (16.8%). This was on 5/3/61. *Anisops* is the principal secondary consumer in the open waters of the pond. It was observed to eat *Boeckella* and also Chironomid flies as they were emerging from the water, but it doubtless consumes a variety of aquatic organisms and ones which fall on to the surface film. A brief experiment with a starved *Anisops* showed it to eat five *Boeckella* in 24 hours. If this is assumed to be a normal rate of consumption, the 435 *Anisops* would have consumed 2,175 *Boeckella*, what was almost half the standing crop on that day. Such figures are very rough and unreliable, but they indicate that the sizes of the populations of *Boeckella* and of *Anisops* may be closely related.

Living as an ectoparasite on *A. assimilis* is the larval stage of a water mite. I am indebted to Dr V. Stout, of the Zoological Department of the University of Canterbury, for general information about water mites and for confirming the attribution of these specimens to the genus *Hydrachna*. The life history of *Hydrachna maramauensis* was described by Stout (1953). The eggs are laid in plant tissue, especially *Potamogeton,* which is a common plant in the pond, and hatch after a period of 4 to 7 weeks. The larvae are small and red and they swim in the water. They take no notice of hosts until two days old, and they die if not attached to a host by the eighth day. When the larva has attached itself to a host insect by sinking in its mouthparts, it becomes a nymphophan. The nymphophan increases in size, the body becomes pear-shaped, and the legs are often lost. Later the body shrinks away from the walls and the nymph, which will emerge later, can be seen through the nymphoderma, or skin of the nymphophan. Stout records that *H. maramauensis* passes approximately four months as a nymphophan. The nymph, when it emerges, immediately attaches itself to some plant and remains quiet for about two days. After that some may swim or others may remain attached, but after a period of metamorphosis of 4 to 10 days the adults appear, and these survive only a few weeks.

In the tow-net samples only the nymphophan stage, attached to the bug, was caught in any numbers. Adults were occasionally taken but no larvae were recognised. It is not clear in which stage the mite overwinters. No parasitised bugs were caught before 5/2/61, and bug nymphs first appeared in numbers on 8/1/61. On 5/2/61, in a sample of 16 bugs, 13.3% of the adults and 10.9% of the nymphs had parasites and none had more than one parasite. On 11/2/61 in a sample of 369 bugs, 17.6% of the adults and 9.2% of the nymphs were parasitised, and of the 30 individuals counted with parasites seven had more than one parasite. Of these seven, five were adults. On 5/3/61, in a sample of 435 bugs, 15.1% of the adults and 18.2% of the nymphs were parasitised, with three individuals, two of them adults, having more than one parasite.



Graphs of the numbers of nymphs and adults of *A. assimilis* White contained in samples taken at intervals of four weeks between June, 1960, and July, 1961. Each sample consisted of a 32 metre haul with a 30 cm tow-net.

No later samples contained parasitised nymphs, and this is probably due to the moulting and growth of the nymphs to adults. Parasitised adults were found until the end of the sampling period, and it is interesting to note that nymphophans attached to the body of the host were well developed, while those attached to the legs were small and undeveloped. This may be due to the fact that they can easily be knocked off by the host and that moulting would result in the loss of parasites attached to the legs. In each sample nymphophans were mostly on the mid-line of the upper surface of the thorax, and perhaps these would not be removed by moulting of the host.

Length measurements of nymphophans caught on 5/2/61 and 5/3/61 showed that there had been two periods of infection. On 5/2/61, of the nine nymphophans caught, two were 1.5 mm long and the rest were less than 0.7 mm long. On 5/3/61, 11 were more than 1.25 mm long and the remaining 30 were less than 0.7 mm long. If the nymphophans take about four months to develop, as Stout says for *H. maramauensis*, then these two size groups may contain individuals which hatched about the same time. Table I shows the numbers of adult *A. assimilis* infected with the larval mite. The percentage of adults infected is quite high and appears to be influenced by the growth of nymphs with parasites.

Table II shows the numbers of nymphs of *A. assimilis* infected with the larval mite.

Table III shows the positions of attachment of the nymphophans, and shows that three-quarters of them are attached on the thorax.

Reference

Stout, V., 1953. New Species of Hydracarina, with a Description of the Life History of Two. *Trans. roy. Soc. N.Z.* 81 (3): 417–466.

Table I.—INFECTION OF ADULT *A. ASSIMILIS*.

Date	Total Bugs	No. of Adults	% Adults	Adults Parasitised	% Parasitised	No. of Adults with more than one Parasite	Total Parasites on Adults
24/7/60	3	3	100	0			
21/8/60	2	2	100	0			
18/9/60	0	0	—	0			
16/10/60	3	3	100	0			
12/11/60	5	5	100	0			
11/12/60	8	7	87.5	0			
8/1/61	92	3	3.3	0			
5/2/61	76	30	39.5	4	13.3	1	5
11/2/61	369	74	20.0	13	17.6	5	18
5/3/61	435	73	16.8	11	15.1	2	13
2/4/61	35	27	77.2	10	28.6	1	15
2/5/61	131	131	100.0	27	20.6	10	49
28/5/61	3	3	100	2	(66.6)	0	2
24/6/61	5	5	100	1	(20.0)	1	3

Table II.—INFECTION OF NYMPHAL *A. ASSIMILIS*.

Date	Total Bugs	No. of Nymphs	% Nymphs	Nymphs Parasitised	% Parasitised	No. of Nymphs with more than one Parasite	Total Parasites on Nymphs
24/7/60	3	0	0	0			
21/8/60	2	0	0	0			
18/9/60	0	0	0	0			
16/10/60	3	0	0	0			
12/11/60	5	0	0	0			
8/1/61	92	89	96.7	0			
5/2/61	76	46	60.5	5	10.9	0	5
11/2/61	369	295	80.0	27	9.2	2	30
5/3/61	435	362	83.2	66	18.2	1	74
2/4/61	35	8	22.8	0			
2/5/61	131	0	0	0			
28/5/61	3	0	0	0			
24/6/61	5	0	0	0			

Table III.—POSITIONS OF ATTACHMENT OF THE NYMPHOPHANS.

Total Bugs Infected	No. of Nympho-phans	% of Nympho-phans on Thorax	% of Nymphophans on Legs	% of Nympho-phans on Head	% of Nympho-phans on Abdomen	% of Nympho-phans on Wing
166	207	75.8	11.1	7.2	3.4	2.4

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